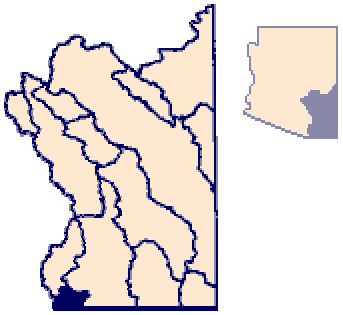
SAN RAFAEL BASIN



The San Rafael basin is located in southeastern Arizona and occupies 172 square miles (Figure 17). The basin consists of the broad, north-trending San Rafael Valley, surrounded by block-fault mountains. The basin is bounded on the west by the Patagonia Mountains, on the north and east by the Canelo Hills, and on the south by the International Boundary with Mexico. The basin is a high semi-arid desert grassland with elevations of 4,600 to 5,100 feet above mean sea level. Elevations in the surrounding mountains range from 7,220 feet above mean sea level in the Patagonia Mountains to 6,170 feet above mean sea level in the Canelo Hills.

The main drainage in the basin is the Santa Cruz River and its tributaries. The headwaters of the Santa Cruz River are in the northern portion of San Rafael Valley. The river flows south through the valley into Mexico for 35 miles and then flows back north into the United States near Nogales, Arizona. Beginning about five miles north of the International Boundary near Lochiel, Arizona, the river becomes perennial for about a two-mile reach. The remainder of the Santa Cruz River within the basin is ephemeral.

The alluvial sediments in San Rafael Valley can be divided into three basic units: streambed alluvium, pediment gravels, and basin-fill alluvium (Simons, 1974). The streambed alluvium outcrops in a narrow strip along the Santa Cruz River and in major tributary washes. The streambed alluvium is composed of well-sorted silt, sand, and gravel. The pediment gravels form gravel terraces along the valley's eastern side (Simons, 1974). The basin-fill alluvium which occupies most of the valley is composed of clay, silt, sand, and gravel. The thickness of the basin-fill remains unknown, but several deep wells have been drilled in the basin and one well in Township 23 South, Range 17 East, Section 9, reportedly penetrated at least 1,990 feet of alluvium (Arizona Department of Water Resources, 1991).

The streambed alluvium and the basin-fill alluvium are hydrologically connected and form the main aquifer in the San Rafael basin. Only minor amounts of water are found in the surrounding mountains. Wells completed in the streambed alluvium generally have higher well yields than wells completed in the basin-fill alluvium. Reported yields from the streambed alluvium range from 115 to 350 gallons per minute. Wells in the basin-fill typically yield 3 to 35 gallons per minute, however, several wells have reported yields of up to 465 gallons per minute.

Water levels indicate that groundwater movement is from the surrounding mountains toward the Santa Cruz River and then south. Water levels are shallowest in the streambed alluvium and deepest in the basin-fill. Depth to water in the streambed alluvium ranges from 10 to 25 feet below land surface (Murphy and Hedley, 1984). Water levels are usually over 100 feet below land surface in the basin-fill and the deepest reported water level is 344 feet below land surface (Arizona Department of Water Resources, 1991).

Sources of recharge to the basin are mountain-front recharge and infiltration of runoff in ephemeral washes. No estimates exist of the total amount of basin recharge. No long-term changes in water levels have been observed, suggesting that a balance exists in the basin between groundwater discharge and groundwater recharge.

Groundwater development in the basin is very small. The Arizona Department of Water Resources (1988) estimates that groundwater use is less than 100 acre-feet per year. Groundwater is pumped for domestic, stock and irrigation purposes. Ranching is the main activity in the basin and most groundwater is used for watering livestock. Irrigation is small and limited to about 200 acres, mostly in 5-to-20 acre plots located along the Santa Cruz River. Domestic use is also very small, limited to a few scattered ranches in the valley.

The chemical quality of water in the basin is suitable for most uses. Total dissolved solids and fluoride concentrations are uniformly low throughout the basin. Total dissolved solids concentrations, which ranged from a low of 96 milligrams per

liter (mg/l) to a high of 600 mg/l, averaged 253 mg/l (Murphy and Hedley, 1984). Only one sampled well exceeded the recommended secondary maximum contaminant level of 500 mg/l for total dissolved solids. Fluoride concentrations also were very low, ranging from 0.1 to 0.7 mg/l and averaging 0.3 mg/l (Murphy and Hedley, 1984).